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Description

APPARATUS FOR SEALING CONTAINERS

BACKGROUND OF THE INVENTION

[0001] The present invention relates to apparatus for sealing the openings of cuplike containers with a strip of lid material, for example, with dessert or the like contained therein.

[0002] The conventional apparatus of the type mentioned and already known comprise a sealing head for sealing the peripheral edge portion of a lid to the inner surface of downwardly tapered body wall of a container. The sealing head has a seal holding surface fittable to the body wall inner surface of the container, and the entire seal holding surface is a smooth surface having no indentations or projections (see, for example, the publication of JP-A No. 2002-255103).

[0003] A slack is inevitably produced in the peripheral edge portion of the lid at the time of sealing. If the slack is held by the seal holding surface of the sealing head, the slack fails to escape, forming wrinkles. The wrinkles are sealed as folded. The sealed wrinkles are not uniform but differ in

size and location of occurrence circumferentially of the sealed portion of the container. At the location where a great crease occurs or many wrinkles are produced, sufficient sealing pressure is not available to produce a faulty seal. On the other hand, uneven wrinkles affect the aesthetic appearance of the sealed portion.

SUMMARY OF THE INVENTION

[0004] An object of the present invention is to provide an apparatus for sealing containers to give an improved aesthetic appearance to the sealed portions while eliminating faulty seals.

[0005] The present invention provides an apparatus for sealing containers which comprises a sealing head for sealing a peripheral edge portion of a lid to an inner surface of a downwardly tapered body wall of the container, the sealing head being provided with a seal holding face fittable to the body wall inner surface, the apparatus being characterized in that recesses are formed respectively in a plurality of portions of the seal holding face along the circumference thereof for guiding slack produced in the lid peripheral edge portion at the time of sealing.

[0006] With the container sealing apparatus of the present invention, the slack produced in the peripheral edge portion of

the lid is guided to the recesses, and the wrinkles due to the slack are formed at the predetermined parts of the sealed portion.

[0007] Further the conventional container sealing apparatus of the type described tend to produce higher pressure inside the container than outside the container, whereas we have found that the presence of recesses is less likely to produce positive pressure inside the sealed container. If the container has internal positive pressure, the air inside the container will act to escape from the container through a portion of relatively weak seal joint between the container and the lid, creating a pinhole in this portion to result in a faulty seal. The reason why the interior of the container is less likely to have positive pressure appears attributable to the recesses which provide vent channels through which air is released from between the container body wall and the lid peripheral edge portion.

[0008] The present invention therefore precludes faulty seals due to uneven wrinkling and also obviates faulty seals due to the internal pressure of sealed containers.

[0009] In the case where the seal holding face has an upper region and a lower region, and when the recesses are positioned in the lower region, the slack is guided by the

lower region, permitting the upper region to produce a reliable seal.

[0010] If the recesses are open downward at their lower ends, wrinkles are guided by the recesses extending to the lower end of the seal holding face initially when the lid is progressively bent, and therefore easily guided by the recesses. Accordingly, the wrinkles can be formed suitably. Moreover, air can be removed efficiently through the vent channels provided by the recesses, whereby faulty seals can be precluded more effectively.

[0011] When the recesses are each in the form of a groove extending vertically and are arranged at a constant spacing, wrinkles can be formed uniformly, consequently giving an improved aesthetic appearance to the sealed portion.

[0012] If the recesses have a width approximately equal to the spacing between the adjacent recesses, this contributes to a further improvement in the aesthetic appearance.

[0013] The container sealing apparatus further comprises a holder for holding the container. The holder has a container inserting bore, and an inner peripheral surface of the holder defining the bore has an upper end portion providing a seal bearing face corresponding to the seal holding face. The seal bearing face has a diameter which

is constant over the entire length thereof and equal to the outside diameter of the upper end of the container body wall. The wedge action of the seal holding face and the seal bearing face then produces an improved sealing effect.

Brief Description of the Drawings

[0014] FIG. 1 is a vertical cross sectional view of a sealing apparatus of the invention;

[0015] FIG. 2 is a view in horizontal section taken along the line II–II in FIG. 1;

[0016] FIG. 3 is an enlarged view in section showing a sealing head and the vicinity thereof;

[0017] FIG. 4 is a view for illustrating the sealing head in detail;

[0018] FIG. 5 includes views for illustrating a sealing operation by the apparatus;

[0019] FIG. 6 includes views subsequent to the views of FIG. 5 for illustrating the sealing operation;

[0020] FIG. 7 is a view for illustrating a seal produced; and

[0021] FIG. 8 is a perspective view of a container as sealed by the apparatus.

Description of the Preferred Embodiments

[0022] An embodiment of the invention will be described below

with reference to the drawings.

[0023] FIG. 8 shows a container C and a lid L which are produced by the container sealing apparatus of the present invention.

[0024] The container C is in the form of a circular cup of paper and has a downwardly tapered body wall B. The container C has a curl portion K at a brim defining an upper-end opening of the body wall B. The lid L is produced by blanking a lid material F of thermoplastic film, and is allowed to fall into the upper-end opening of the body wall B to form an upstanding rim R. The outer peripheral surface of the rim R is heat-sealed to the inner peripheral surface of the upper end of the body wall B. The upstanding rim R has a multiplicity of inwardly projecting vertical wrinkles M formed in a lower region thereof and arranged at a spacing. A tab T is provided integrally with a portion of outer periphery of the rim R.

[0025] With reference to FIGS. 1 and 2, the container sealing apparatus comprises a horizontal turntable 12 provided with a plurality of container holders 11 (only one shown) equidistantly spaced apart on a circumference at a predetermined distance from the center O of rotation, and intermittently drivable so as to stop the container holders

11 one after another at a sealing station S, a lid material transport device 13 for supplying the strip of lid material F to the sealing station S so as to position the lid material F across and above the container holder 11 as stopped at the station S, a vertically movable assembly 14 disposed at the sealing station S above the turntable 12, a vertical tubular cutter 15 depending from and attached to the assembly 14 for blanking out a lid L from the strip of lid material F along the container brim so as to separate the lid L from the remaining portion of the lid material F, a sealing head 16 disposed inside the cutter 15 for sealing a peripheral edge portion of the blanked lid L to the inner surface of the container brim portion, and a lid material holder 17 surrounding the cutter 15.

[0026] The container holder 11 is in the form of a horizontal rectangular plate having a circular container holding bore 21 vertically extending therethrough. As shown in greater detail in FIG. 3, the container holding bore 21 has a diameter which is constant over the entire length thereof and equal to the outside diameter of upper end of the body wall B. The inner peripheral surface of the container holder 11 defining the container holding bore 21 has a seal bearing face 22 at its upper end portion. The holder

11 has a container bearing face 24 at the upper-end opening edge portion of the seal bearing face 22 and an annular cutter escape groove 23 surrounding the container bearing face 24. Although annular in its entirety, the escape groove 23 has a bulging portion 23a at a portion thereof corresponding to the tab T. The container holder 11 has at its top a lid material bearing face 25 externally of the groove 23. The lid material bearing face 25 is at a higher level than the container bearing face 24.

[0027] The body wall B is fitted into the container holding bore 21 with the curl portion K received by the container bearing face 24, whereby the container C is held by the holder 11.

[0028] The vertically movable assembly 14 comprises a horizontal top plate 33 movable upward and downward by a first fluid pressure cylinder 32 facing vertically downward and attached to a support member 31, a horizontal bottom plate 34 disposed below the top plate 33 at a distance therefrom, first spacers 35 in the form of vertical rods and arranged between the top plate 33 and the bottom plate 34 at outer peripheral edge portions thereof, and a second fluid pressure cylinder 36 connected to the piston rod of the first fluid pressure cylinder 32, mounted on the up-

per side of the top plate 33 centrally thereof and facing vertically downward.

[0029] First guide rods 41 extending vertically downward are attached to the first cylinder 32. The first guide rods 41 slidably extend through the top plate 33 in the vicinity of the first spacers 35.

[0030] The top plate 33 has a rod hole 42 centrally thereof with the piston rod of the second cylinder 36 inserted through the hole. A head hole 43 is formed in the bottom plate 34 centrally thereof. The bottom plate 34 has a container holding member 52 in the form of a vertical sleeve and extending downward from the inner periphery thereof defining the head hole 43. A horizontal head mount disk 44 is connected to the piston rod of the second cylinder 36. Second guide rods 45 are provided upright on the upper side of the head mount disk 44 at peripheral edge portions thereof. The second guide rods 45 slidably extend through the top plate 33 to a position thereabove, between the second cylinder 36 and the respective first guide rods 41. A stopper 46 is provided at the upwardly projecting end of each second guide rod 45. A second spacer 47 provided around the upward projection of the rod 45 is interposed between the top plate 33 and the

stopper 46.

[0031] The cutter 15 is fixedly suspended from the lower side of the bottom plate 34 so as to surround the container holding member 52 and has a blade 51 positioned precisely above the cutter escape groove 23.

[0032] The sealing head 16 comprises a vertical tubular heater 61 attached to the lower side of the head mount disk 44 to depend therefrom and having a lower end portion extending through the head hole 43, and an annular sealing member 62 attached to the lower end of the heater 61 and to be heated by the heater 61.

[0033] The sealing member 62 is provided along the outer periphery of its bottom with a downwardly projecting annular portion 71. The outer periphery of the sealing member 62 including the annular portion 71 has a downwardly tapered seal holding face 72 fittable to the inner surface of the container body wall B.

[0034] A suspension rod 73 extends downward from the center of lower side of the head mount disk 44 axially of the sealing head 16. The suspension rod 73 is provided at its lower end with a lid suction member 74 in the form of a horizontal disk. The lid suction member 74 has an outer peripheral portion positioned inwardly of the annular por-

tion 71. The suction member 74 has a bottom surface slightly projecting downward beyond the lower face of the annular portion 71.

[0035] The head mount disk 44 has a lateral suction channel 75 extending from its outer periphery toward the center and having a bottom. A vertical suction channel 76 extends downward through the axis of the suspension rod 73 from the bottom of the channel 75. The vertical suction channel 76 has a lower-end opening formed in the bottom surface of the lid suction member 74.

[0036] The lid material holder 17 is in the form of a horizontal plate having the same shape as the lid material bearing face 25 when seen from above. The lower surface of the lid material holder 17 is entirely covered with an elastic material 81. Third guide rods 82 are provided upright on the upper side of the holder 17 at a plurality of locations, respectively. The third guide rods 82 have upper ends slidably extending through the bottom plate 34 and each having a stopper 83. A second compression coil spring 84 provided around each third guide rod 82 is interposed between the bottom plate 34 and the lid material holder 17.

[0037] As shown in detail in FIGS. 3 and 4, the outer peripheral surface of the sealing member 62 has a straight cylindrical

face above the seal holding face 72. The seal holding face 72 has an upper region 91 and a lower region 92 which have a boundary therebetween at an intermediate portion of the height of the holding face 72. The upper region 91 is smooth-surfaced over the entire circumference thereof, while the lower region 92 has a multiplicity of recesses 93 equidistantly spaced apart circumferentially thereof. Each of the recesses 93 resembles a vertically extending groove in shape and has a lower end which is open downward. The recesses 93 have a width W1 which is approximately equal to the spacing W2 between the adjacent recesses 93. However, the number of recesses 93 is suitably variable over the range of about 4 to about 360, preferably over the range of 10 to 120. With reference to FIG. 7, the bottom of each recess 93 has a circular-arc contour in cross section. The recess 93 has a depth which is preferably at least 1/4 of the width W1 thereof.

[0038] The vertically movable assembly 14 is moved upward or downward by the operation of the first fluid pressure cylinder 32, and the sealing head 16 is moved upward or downward relative to the assembly 14 by the operation of the second fluid pressure cylinder 36.

[0039] With reference to FIG. 1, the lower surface of the lid mate-

rial holder 17 and that of the lid suction member 74 are generally at the same level when the vertically movable assembly 14 is positioned at the upper limit of its vertical stroke, with the sealing head 16 positioned at the upper limit of its vertical stroke. The blade 51 of the cutter 15 is positioned at a level higher than this level.

[0040] In this state, the piston rod of the first cylinder 32 is at the retracted limit position, and the piston rod of the second cylinder 36 is at the advanced limit position. At this time, the supply of air to the second cylinder 36 is stopped, and when the piston rod of the cylinder is pushed upward, the rod is free to retract.

[0041] The container is sealed by the operation to be described next with reference to FIGS. 5 and 6.

[0042] FIG. 5(a) shows the apparatus in the same state as in FIG. 1. The vertically movable assembly 14 is lowered to a position where the lid material holder 17 and the lid suction member 74 are brought into contact with the lid material F as shown in FIG. 5(b).

[0043] When the assembly 14 is subsequently lowered, the second compression coil springs 84 are compressed as seen in FIG. 5(c), bringing the cutter 15 into contact with the lid material F, with the lid material F held by the lid material

holder 17 with the force of the springs. At the same time, the reaction of the lid material F overcomes the gravity acting on the sealing head 16, etc., retracting the piston rod of the second fluid pressure cylinder 36, whereby the sealing head 16 is raised relative to the assembly 14.

[0044] The assembly 14 is further lowered to its lower limit position, causing the cutter 15 to blank out a lid L from the lid material F in the meantime as shown in FIG. 6(d). In blanking out the lid L, the force of the second compression coil springs 84 acts on the lid material F externally of the cutter 15 and the weight of the sealing head 16, etc. acts on the material F internally of the cutter 15. This prevents the shift of the portion to be blanked out, assuring the cutter 15 of improved cutting performance. The lid L blanked out is attracted by the lid suction member 74.

[0045] Upon the descent of the assembly 14 to its lower limit position, air is supplied to the second cylinder 36 to advance the piston rod thereof and lower the sealing head 16 as shown in FIG. 6(e). This movement brings the sealing member 62 into a container body wall B with the lid L held attracted by the lid suction member 74. At this time, the outer peripheral portion of the lid L including the tab T forms an upstanding rim R. The seal holding face 72 of

the sealing member 62 placed into the container body wall B is pressed against the seal bearing face 22 of the container holder 11, with the body wall B and the upstanding rim R interposed therebetween, whereby the body wall B and the upstanding rim R are heat-sealed.

[0046] The seal holding face 72 is tapered downward, while the seal bearing face 22 is vertical. Accordingly, the heat-sealing operation produces a sealing pressure gradually decreasing from above downward between the seal holding face 72 and the seal bearing face 22 instead of producing a uniform sealing pressure between the two faces 72, 22. This ensures an improved sealing effect since the seal joint is given an increased strength where it is subjected to greater sealing pressure.

[0047] Furthermore, the portion to be sealed by the upper region 91 of the sealing member 62 is uniformly sealed over the entire circumference, whereas the portion to be sealed by the lower region 92 is sealed only at parts pressed by the parts of the region 92 other than the recesses 93. The slack parts of the lid peripheral portion which are produced at this time make wrinkles M in the recesses 93 as shown in FIG. 7, and the wrinkles M remain unsealed.

[0048] At the time of sealing, air is released through the recesses

93 from between the surface of the container to be sealed and the lower surface of peripheral edge portion of the lid.

[0049] The sealing head 16 is thereafter raised along with the vertically movable assembly 14. The sealing head 16 is raised first as shown in FIG. 6(f). Even if the sealing head 16 acts to lift the container C as attached thereto at this time, the container C is restrained by the container holding member 52. The assembly 14 is thereafter raised.

[0050] Although containers are transported by the turntable according to the foregoing embodiment, containers may be transported by a conveyor.

[0051] According to the embodiment, the recesses are formed only in the lower region, whereas such recesses may be formed otherwise. The recesses may be formed in one or both of the upper region and the lower region or across the two regions. However, the recessed are provided preferably only in the lower region when the air release function, shape of wrinkles, sealing effect and aesthetic appearance of the product are considered collectively.

[0052] The invention eliminates faulty seals and gives an improved aesthetic appearance to the sealed portion.